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Report of the

Jefferson Laboratory
Program Advisory Committee

PAC 29

Meeting of January 10-13, 2006

Letter from the Director

February 1, 2006

Members of the Jefferson Lab User Group,

One of the greatest pleasures that I have as Director is seeing the new and exciting experimental proposals that come from our user community. The quality of these proposals is an indicator of the forefront scientific program that Jefferson Lab enables for its users, and this PAC was no exception.

This Program Advisory Committee reviewed 18 proposals and 5 letters of intent. The PAC has as a responsibility to remain focused on the very best and most promising science. Peer review, as performed by PAC 29, is critically important to maintaining a research program of forefront, compelling science. Of the 18 proposals submitted, 7 were approved, 2 were conditionally approved, 6 were deferred, and 3 were deferred with regret.

Serving on the PAC is a great responsibility, and we are fortunate to have three new members, Marco Ripani, Michael Pennington, and Xiangdong Ji, willing to take on that responsibility. I also want to thank Andrew Sandorfi and Fritz Klein, who are rotating off the PAC, for their contributions to the Jefferson Lab nuclear physics program and I wish them continued success in their research.

Sincerely,

Christoph W. Leemann
Director, Jefferson Lab

Letter from the PAC Chairman

Introduction

The Jefferson Laboratory Program Advisory Committee held its 29th meeting on January 10-13, 2006. The membership of the Committee is given in Appendix A. In response to the charge (Appendix B) from the JLab Director, Dr. Christoph Leemann, the Committee reviewed and made recommendations concerning the eighteen proposals and five letters of intent submitted by JLab users.

General Overview

The JLab FY06 budget cut by ~9% relative to that of FY05 overshadowed the atmosphere of the meeting. Given the ongoing stream of excellent results from measurements of all Halls and the undiminished demand for beam time such a cut in funding is hard to understand. The PAC has been impressed by the appropriate actions of the management of the Laboratory to minimize the damage to the ongoing physics program as well as to the advanced preparation phase for the 12 GeV JLab upgrade. All this happens in a phase where the scientific results, so far obtained at JLab, led to new initiatives and approaches to develop a deeper understanding of the Hadronic structure of nucleons and nuclei. All this happens in a time where due to the outstanding beam qualities of CEBAF and the development of new experimental methods new classes of experiments become possible. The still increasing interest of bright, young scholars, as reflected on the list of spokespersons of JLAB proposals, underscores the intellectual challenge posed by that physics subfield as well as the confidence to achieve major contributions by using the JLab infrastructure and experimental equipment.

What part of the spin of the proton is due to orbital angular momentum of the quarks, how is the spin decomposed into quark flavours, what is the influence of strange quarks on the static properties of the nucleon, what is the underlying color structure of the nucleon as manifested in the excitation spectrum, what is the border region between a quark-gluon and a Hadronic description of the nucleon, are actual questions concerning the structure of the nucleon. The answers to these questions lead immediately to new questions concerning the nucleus. The nucleus, besides being interesting as a many body system, serves as a study object of nuclear matter as well as of the QCD vacuum that gets changed in the vicinity of a bound nucleon.

Keeping those questions in mind the PAC experienced very soon a stimulating meeting by hearing and discussing the recent results of the three halls and the physics of the proposals and the letters of intent. In Hall A the experiments HAPPEx-II and HAPPEx-He were successfully finished and after analysis an improvement of the error bar of G^s_E $(0.1\ \mathrm{GeV})^2$ by a factor of two will be achieved. The body of data for G^s_E and G^s_M , so far measured and together with the data of the planned G0 (Hall C) and HAPPEx –III (Hall A) experiments, should be soon precise enough to substantiate the astonishing result of e.g. the large isoscalar magnetic moment of 0.88 μ_N for the nucleon . A further important step has been achieved to establish a vigorous program for studies of hypernuclei. In Hall A as well as in Hall C excitation spectra of hypernuclei were extracted out of the first data with a high resolution and a good signal to noise ratio. The search for the Pentaquark Baryons in Hall B yielded upper limits ($\sigma<1$ nb) for the reactions: $\gamma D \rightarrow p K^-(K^+ n)$, $\gamma p \rightarrow K^0(K^+ n)$, $\gamma D \rightarrow \Lambda(K^+ n)$ and $\gamma p \rightarrow K^-(K^+ p)$. The BONUS detector works excellently in Hall B and allows in the future to measure structure functions on “free” neutrons by identifying the low energy spectator proton.

The overall JLab program continues to show solid growth; prior to PAC 29 it included 166 approved experiments. To date, 121 experiments have been completed at JLab, up by eight over the last six months. Forty one papers have been published or submitted to Physical Review Letters and Physics Letters over the past year, in addition to over 86 papers published (or submitted) in other refereed journals. The number of Ph.D. projects completed to date at JLab is 223 (up by 13 in the past six months), with an additional 197 projects in progress.

Turning to accelerator operations, the accelerator availability has been high and is increasing. The Superlattice cathode is working remarkably well with polarization of 85% and the ability to produce >100 μA per Hall.

Experimental operations statistics for all of FY05 there were 37 weeks of operation with beam availability of 70.6% Hall availability averaged 89.8% and the multiplicity (the average number of halls scheduled to take data) was 2.34. This performance exceeded the planned running for the year.

The physics scope of the proposals presented to PAC29 reflects the tendencies already seen in previous PACs. Two themes dominate the requests for beam time. Six proposals are part of the program of deeply exclusive and semi-inclusive experiments to study the nucleon's internal structure at a finer level and four proposals intend to use parity violating (PV) electron scattering to study, by elastic scattering, the strange nucleon form factors and ^{208}Pb neutron skin and, by inelastic scattering, for the first time the parity-violating inelastic response of the nucleon over the whole resonance region.

Four proposals address the excitation spectrum of the nucleon/deuteron. The remaining four proposals have as their goal the extraction of the longitudinal/transverse response of the proton and neutron, the observation of two photon signals from the neutron, the modification of the mass and width of the ρ-meson in nuclear matter and the study of ^{208}Pb via (e, e'p) at a $Q^2 = 1(\mathrm{GeV})^2$ to provide a data set that allows to discriminate between a relativistic and non-relativistic description of this reaction.

Recommendations

Of the eighteen proposals received, seven experiments were approved, one of them conditionally. The ratings for these seven proposals were two with A, five with A$^-$. Three experiments have been deferred with regret. For the proposals PR-06-010 and PR-06-011 the PAC recommends beam time under the condition that both groups form a single collaboration and present the Laboratory a detailed plan of joint measurements of asymmetries with both positive and negative pions.

The PAC approved four experiments in Hall A for a total of 82 days: PR-06-002, A Clean Measurement of the Neutron Skin of ^{208}Pb, for 30 days; PR-06-007, Impulse Approximation Limitations to the (e,e'p) Reaction on ^{208}Pb, Identifying Correlations and Relativistic Effects in the Nuclear Medium, for 10 days; PR-06-010/11, Target Single Spin Asymmetry in Semi-Inclusive Deep Inelastic Negative/Positive Pion Production on a Transversely Polarized ^{3}He Target, for 29 days; and PR-06-014, Measurement of the d_2: Towards the Electric X_E and Magnetic X_M Color Polarizabilities, for 13 days.

Two experiments have been approved in Hall B for 34 days: PR-06-003, Deeply Virtual Compton Scattering with CLAS at 6 GeV, for 34 days; and PR-06-013, Measurement of π^+ π^- Photoproduction in Double-Polarization Experiments Using CLAS, for 4 days.

One experiment has been approved in Hall C for a total of 9 days: PR-06-009, Measurement of $R=\sigma_L/\sigma_T$ on Deuterium in the Nucleon Resonance Region and Beyond, for 9 days.
For one experiment the conditional approval by PAC28 was removed: PR-06-008, G0 Backward Angle Measurements at $Q^2=0.23$ $(\mathrm{GeV})^2$, for 34 days, including the running during the special 6-week (~25 PAC days) low-energy running period anticipated for summer, 2006. This beam time allocation corresponds to half the amount foreseen for the completion of the experiment at this kinematics. Given the uncertainties in the budget for running times in FY07 and the special running mode of the accelerator in the single user mode, at this very moment the PAC feels unable to make a decision for an allocation of the complete beam time asked for in the proposal.

The laboratory guidelines provided for the approval of 74 days of beam time in Hall A, 79 days of beam time in Hall B, and 9 days of beam time in Hall C. Starting with PAC 24, the formula for these guidelines has been modified, and is based on three components: 30/45/25 days of new time to be made available in Halls A/B/C, plus 100%/100%/100% of the time recovered from approved experiments now required to return to the PAC due to the jeopardy process, and 0%/0%/50% of the days under target in the halls. The PAC is allowed to exceed the laboratory guidelines if it believes the physics has sufficiently high priority, that is at a rating of A- or better, but the excess would then be deducted from the allocation of the next PAC meeting.

The jeopardy process continues to evolve at JLab. At this meeting 105 days of approved time in two proposals

were under jeopardy status, 71 in Hall A and 34 in Hall B. Including the recommendations of PAC29, the backlog in Hall A is now about 4.7 years, while the backlog in Hall B is 3 years and that of Hall C 5.1 years. The requests at this meeting for beam time in all three halls were again beyond the allocation. Given so many outstanding proposals the PAC exceeded the laboratory guidelines in Hall A by 8 days. The low energy running for G0 in FY06 has not been taken into account in those numbers.

The proposal reports and the PAC recommendations for the reviewed proposals and the response to the letter of intent are given in Appendices D and E. The tables on the following pages summarize the status of the JLab commitments from PAC 4-PAC 29.

The PAC is very appreciative of the efforts of the Hall leaders and the Laboratory staff in support of the PAC meeting and review process. The TAC reports continue to be a very important ingredient in the process of evaluation of proposals. The comments provided by the theory group help greatly by putting the proposals in the context of ongoing theoretical work.

The enthusiastic and thoughtful contributions of Karen Owens and Sue Ewing were, once again, especially effective in making the PAC process proceed gracefully and with high efficiency.

Berthold Schoch
Chairman, Jefferson Program Advisory Committee

Tables

Totals for PAC 4-29

	Experiments Recommended for Approval	Experiments Recommended for Conditional Approval	Totals
Experiments	170	4	174
Authors	1193	36	1229
Institutions	209	3	212
Countries	30		30

Approved Experiments Totals by Physics Topics

Topic				
	Number	**Hall A**	**Hall B**	**Hall C**
Nucleon and Meson Form Factors & Sum Rules	30	11	6	13
Few Body Nuclear Properties	29	18	6	5
Properties of Nuclei	32	10	11	11
N* and Meson Properties	56	10	34	12
Strange Quarks	23	5	15	3
TOTAL	170	54	72	44

Approved Days and Conditionally Approved Experiments

Hall	**Approved Experiments**				Conditionally Approved Experiments
	# Expts Completed (full/partial)	Days Run	No. Exps in Queue	Days to be Run	
A	36 0	664.9	20	332	2
B	58 3	599.8	13	282	1
C	28 4	609.4	15	331.1	1
Total	122 7	1874.2	48	945	4

APPENDICES

A. PAC 29 Membership

B. Charge to PAC 29

C. PAC 29 Recommendations

D. PAC 29 Individual Proposal Reports

E. PAC 29 Individual Letters-of-Intent Reports

F. Approved Experiments, PACs 4-29, Grouped by Physics Category

(To access Appendix F, go to http://www.JLab.org/exp_prog/PACpage/)

Appendix A
PAC 29 Membership

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Appendix B

Charge to PAC 29

Jefferson Lab requests that PAC 29:

1) Review both new proposals* and extensions† or updates‡ to previously-approved proposals, and provide advice on their scientific merit, technical feasibility and resource requirements.
2) Recommend one of four actions on each proposal, extension or update:
   - approval,
   - conditional approval status pending clarification of special issues,
   - deferral with regret,
   - deferral, or
   - rejection.

   (There are two types of conditional approval: conditional pending PAC review of open scientific questions; and conditional pending Jefferson Lab management review of open technical issues. In the later case, the PAC should recommend a beam time allocation.)
3) Provide a scientific rating and recommended beam-time allocation for all proposals recommended for approval.
4) Provide comments on letters-of-intent.
5) Comment on the Hall running schedules.

* Previously-approved proposals that have not, within 3 years of PAC approval, been scheduled to run to completion are returned to the PAC for a fresh scientific review. For the purposes of these reviews, the "jeopardy" experiments are to be treated consistently with new proposals.

† Extension proposals are treated as new proposals, and the merits and status of the original proposal are considered only to the extent that they may bear on the relevance and merit of the extension proposal.

‡ In reviewing an experiment update, the PAC will treat the original proposal and any request for changes taken together as a single new proposal and treat the combination in a manner analogous to a previously-approved proposal undergoing a jeopardy review.

APPENDIX C

PAC 29 Recommendations

DR	PR-06-001	Polarization transfer in Wide Angle Compton Scattering
A/A/30	PR-06-002	A Clean Measurement of the Neutron Skin of ^{208} Pb Through Parity Violating Electron Scattering
A/A-/34	PR-06-003	Deeply Virtual Compton Scattering with CLAS at 6 GeV
D	PR-06-004	Strangeness form factor of the proton at 2 $(GeV/c)^2$
DR	PR-06-005	Parity Violating Electron Scattering in the Resonance Region (Res-Parity)
D	PR-06-006	The $\gamma p \rightarrow \pi^+ + n$ Single Charged Pion Photoproduction
A/A-/10	PR-06-007	Impulse Approximation limitations to the (e,e'p) reaction on ^{208}Pb, identifying correlations and relativistic effects in the nuclear medium
A/A/tbd	PR-06-008	Update for PR 05-108: G0 Experiment Backward Angle Measurement at Q^2=0.23 GeV^2
A/A-/9	PR-06-009	Measurement of $R=\sigma_L/\sigma_T$ on Deuterium in the Nucleon Resonance Region and Beyond
C1/A/24	PR-06-010	Target Single Spin Asymmetry in Semi-Inclusive Deep-Inelastic Negative Pion Production on a Transversely Polarized ^{3}He Target
C1/A/24	PR-06-011	Target Single Spin Asymmetry in Semi-Inclusive Deep-Inelastic Positive Pion Production on a Transversely Polarized ^{3}He Target
DR	PR-06-012	A Parasitic Measurement during E03-004 for Target Single-Spin Asymmetry in Inclusive DISn (e,e') Reaction on a Vertically Polarized ^{3}He Target
A/A-/4	PR-06-013	Meaurement of $\pi^+\pi^-$ Photoproduction in Double-Polarization Experiments using CLAS
A/A-/13	PR-06-014	Measurement of the d_2:Towards the Electric X_E and Magnetic X_M Color Polarizabilities
D	PR-06-015	Deeply Virtual Compton Scattering on the Deuteron with CLAS at 6 GeV
D	PR-06-016	Search for the Modification of Vector Meson Properties in Nuclei
D	PR-06-017	Measurement of the Gerasimov-Drell-Hearn Integral at low Q^2 on the Deuteron and Neutron
D	PR-06-018	Threshold Contribution to the Deuteron Extended Gerasimov-Drell-Hearn Sum Rule

- A=Approve, C=Conditionally Approve, D=Defer, DR= Defer with Regret, R=Reject

Appendix D

Individual Proposal Report

Proposal: PR-06-001

Scientific Rating: N/A

Title: Initial State Helicity Correlation in Wide Angle Compton Scattering

Spokespersons: B. Wojtsekhowski, A. Nathan, R. Gilman

Motivation: This proposal is a jeopardy update of experiment E03-003. The experiment's goal is a measurement of three spin-dependent observables, K_{LL}, K_{LS}, and P_N, in Real Compton Scattering (RCS) off protons at wide angles. The measurements are planned at three kinematic points with $s = 9$ GeV^2 and θ_p^{cm} = 70º, 90º, and 110º. There is growing theoretical and experimental support that the RCS reaction, at values of s, $|t|$, and $|u|$ significantly larger than the nucleon mass squared, is dominated by the "handbag diagram" and so can be described within the framework of the Generalized Parton Distributions (GPDs). Specifically, in the GPD framework, each of the three RCS response functions is sensitive to the $1/x$-weighted integral over x of one of the GPD's (summed over flavor): $R_V(t)$, $R_A(t)$, and $R_T(t)$ are related to the moments of $H^q(x,\xi=0,t)$, $\tilde{H}^q(x,\xi=0,t)$, and $E^q(x,\xi=0,t)$ respectively.

The measurement of the spin-transfer observables K_{LL} and K_{LS}, when combined with the existing RCS cross-section measurements from experiment E99-114, would permit the independent determination of the three RCS response functions, and so of the aforementioned GPD moments. This would provide valuable new constraints on emerging models of the GPDs. The results would also permit some further testing of the hypothesis that the handbag diagram is, in fact, dominant in this kinematic regime: calculations in this framework predict a distinct pattern, with sizable positive values for K_{LL} which are larger at backward angles, small K_{LS} in the range 0 – 0.2, and vanishingly-small proton polarization P_N. (The approved experiment E05-101 will also test the handbag prediction $A_{LL} \approx K_{LL}$, at similar kinematics.)

Measurement and Feasibility: The proposed experiment was deemed feasible, and no experimental problems were identified. The proposal creatively optimized the resources of experimental Halls A & C in recognizing that the two backward kinematic points are best measured in Hall A while the forward point is best measured in Hall C (requiring 3 rather than 15 days of data-taking). Considerable installation work is required: 1 month in Hall A, followed by 17 days of running. In Hall C, careful scheduling of the experiment would reduce the installation time to only a couple of days, followed by 3 days of running. The total requested beam time of 20 days is larger than the 7 days originally approved for experiment E03-003. This change is in response to a concern from the PAC review of E03-003 that the original beam energy of 3.2 GeV might lead to large target mass corrections and consequent uncertainties in the response functions. This updated proposal has chosen a beam energy of 4.3 GeV, and because of the resulting decrease in cross-section, requires more running time to achieve the same level of precision. The present PAC supports this change, as the new kinematic points have both $-t$ and $-u > 2$ GeV^2, in accordance with the theoretical requirement for handbag dominance that these values be significantly larger than the nucleon mass squared.

Issues: Merely due to lack of available beam time, the PAC was unable to approve this experiment.

Recommendation: Defer with regret

Individual Proposal Report

Proposal: PR-06-002

Scientific Rating: A

Title: A Clean Measurement of the Neutron Skin of ^{208}Pb through Parity Violating Electron Scattering

Spokespersons: R. Michaels, P. Souder, G. Urciuoli

Motivation: The proponents aim to measure the nuclear surface symmetry energy of ^{208}Pb using PV scattering. While the volume symmetry energy is well known from the fits of the semi-empirical mass formula to nuclear masses, the surface symmetry energy, which gives the density dependence of the symmetry energy, is poorly known. The density dependence of the symmetry energy is a fundamental quantity in nuclear physics and is important for calculating hadron-nucleus cross sections and for astrophysics. The use of the Q^2 dependence of the electron longitudinal asymmetry is free from reaction-model uncertainties inherent in the use of other probes. The scientific impact of a determination of the surface symmetry energy (or neutron skin thickness) with the planned accuracy will be large.

Measurement and Feasibility: The measurement is the most challenging in the series of HAPPEX experiments and makes use of the technology developed for the HAPPEX program. Most of the requirements of the experiment have already been achieved. With the techniques already demonstrated, the systematic uncertainty will be smaller than the statistical uncertainty. The group has identified transverse electron polarization as a potential source of systematic uncertainty and has developed techniques such as the use of the pair of HRS spectrometers and vertical segmentation of the detector package to measure and control the transverse polarization. They have studied the pole tip scattering and shown this source of systematic uncertainty to be small. The Pb target has been tested at currents higher than the proposed. The measurement appears to be technically feasible.

Issues: The issue of two-photon contribution to the asymmetry should be studied theoretically.

Recommendation: Approve for 30 days in Hall A

Individual Proposal Report

Proposal: PR-06-003

Scientific Rating: A–

Title: Deeply Virtual Compton Scattering with CLAS at 6 GeV

Spokespersons: V. Burkert, L. Elouadrhiri, M. Garcon, St. Stepanyan

Motivation: This experiment is a jeopardy request to complete the approved experiment E-01-113. The principal goal of the experiment is a precise measurement of the single-spin asymmetry A_{LU} in Deeply Virtual Compton Scattering (DVCS) from a longitudinally-polarized hydrogen target using a 6 GeV electron beam and the CLAS detector. Previous measurements of several DVCS asymmetries by both the CLAS and HERMES collaborations, at similar kinematics to those of the proposed experiment, have been well described by the "handbag diagram" and the Generalized Parton Distribution (GPD) formalism, and this experiment promises information of new precision and more refined kinematic binning that previously available. The azimuthal dependence of the DVCS beam-spin asymmetry $A_{LU}(\phi)$ provides information chiefly on the GPD H along the off-forward kinematic line $x = \pm\xi$.

Measurement and Feasibility: The experiment was originally approved to run for a total of 60 days with 6 GeV beam at 80% polarization. In spring 2005, 36 days of data were taken, at a somewhat reduced beam energy of 5.76 GeV. Although this corresponds to 60% of the approved number of days, only 43% of the anticipated total luminosity of 10^{41} cm^{-2} was collected due to an initially-lower operational efficiency than expected. An additional 34 days are thus requested in this proposal to achieve the full luminosity goal. Further, the collaboration is eager to complete the second half of the experiment at the full 6 GeV beam energy of the original proposal, which will give a slightly larger kinematic reach in Q^2 and x than the 5.76 GeV of the collected data.

Issues: The PAC fully recognizes the importance of this DVCS measurement. However, it was also recognized that the statistical improvement provided by this second running period is modest, serving to reduce the uncertainties by only 35%, while the increased beam energy of 6 GeV provides only a small increase in kinematic reach. The collaboration is encouraged to concentrate on cross-section measurements as well as asymmetries, and to work on reducing the present systematic error of 7 – 8%.

Recommendation: Approve for 34 days in Hall B

Individual Proposal Report

Proposal: PR-06-004

Scientific Rating: N/A

Title: Strangeness form factor of the proton at 2 $(GeV/c)^2$

Spokesperson: B. Wojtsekhowski

Motivation: The proposal is aimed at measuring a combination of the strange form factors (SFF) at large Q^2, thereby extending the data at values larger than 1 $(GeV/c)^2$, which is the limit of experiments like G0 and HAPPEX. The ultimate goal would therefore be to verify if a large signal is observed for the SFF at such a high momentum transfer.

Measurement and Feasibility: This is a Parity Violation (PV) experiment where longitudinally polarized electrons (80%) scatter elastically on a proton target. The beam energy required is 6 GeV at a current of 100 μA. The principle (measuring PV asymmetries to access the weak form factors of the proton) is similar to other PV experiments performed at Jlab. However the experimental approach to access momentum transfers, Q^2, above 1 $(GeV/c)^2$ has to be rather different. It requires a coincidence experiment in a counting mode involving detection of both the scattered electron and the recoil proton in an electron and a hadron calorimeter. The calorimeters would cover 2π in azimuthal angle and would consequently be located at angles matching the kinematics of the elastic scattering process. The identification would be based on cuts on the kinematical correlations of the two particles and on the energy deposited in such non-magnetic counters. The experiment would require all the Hall A PV equipment that is necessary to keep experimental asymmetries at the level of a few ppm (the typical systematic limit for PV SFF experiments). In addition to that, the experiment would require building the two calorimeters, for which a concept has been developed and tested during a parasitic feasibility study. The proposal is asking for a 7 days beam time period for a concept test which will provide a 20% precision on the combination of the FF, and for a 33 days period for the measurement with the aim of reaching an error of about 0.1 on this combination. The feasibility does not appear guaranteed, in view of the various types of challenging backgrounds that may lead to helicity dependent effects, as outlined in more detail below.

Issues: The choice of the Q^2 value remains to be discussed in a general scheme of PV experiments at JLab (cf HappexIII vs G0). The PAC asked the proponents to consider performing the measurements at more than one Q^2 value and in particular suggested that it may be more advantageous to restrict the measurements to Q^2 values closer to the already existing data points. Given the exploratory nature of the first SFF measurement at higher Q^2, it would also make more sense to restrict such measurements to momentum transfer values where we can have a better understanding and interpretation of the SFF from a theoretical point of view. This is less obvious for measurements made at too high Q^2 values. The PAC also asked the proponents to consider the necessary steps to exploit the flexibility of these non-magnetic detectors to possibly achieve a separation of the electric and magnetic SFFs. From the technical point of view, while many concerns about control of beam parameters and other helicity dependent non-PV effects were carefully addressed in the proposal, the question of the dead time variation in coincidence mode remains open, as well as the question of the effect of the rescattering of the outgoing polarized protons in the material between the target and the detector and inside the detector itself. All these issues really demand a more thorough investigation and the PAC looks forward to seeing them addressed in a new proposal.

Recommendation: Defer

Individual Proposal Report

Proposal: PR-06-005

Scientific Rating: N/V

Title: Parity Violating Electron Scattering in Resonance Region (Res-Parity)

Spokespersons: P. Bosted, J. Arrington, V. Dharmawardane, H. Mkrtchyan, X. Zheng

Motivation: The proposal is aimed at measuring Parity-Violating asymmetries on three different targets (H, D, ^{12}C), over the full resonance region (up to a missing mass W = 2.1 GeV) in the Q^2 domain 0.5 - 1.0 $(GeV/c)^2$. This region of the resonances is of concern for many experiments. It will be studied here with a weak probe/coupling, giving access to combinations of quark contributions different than the one obtained with the EM coupling, and for a combination of targets. The physics addressed by this proposal is broader than usual, and is related to several important issues: quark-hadron duality, isospin decomposition of the resonances, and the flavor dependence of the EMC effect. This experiment would also provide important inputs to neutrino cross sections, necessary for the interpretation of key neutrino experiments. Finally the data obtained from this proposal could also be of help for other PV measurements such as E-158 or DIS-Parity (background, higher twist corrections and modeling the radiative corrections).

Measurement and Feasibility: Little change was necessary to the experimental set-up of the previous proposal to PAC 28. The experiment is still proposed to run in Hall A, but has now requested 30 days (instead of 15 days for PAC 28). This has been motivated by the fact that to address issues related to neutrino experiment and EMC effect improved statistical errors were requested.
The experiment uses the same equipment as E05-007 (DIS-Parity experiment). The DIS- and Res-Parity collaborations are closely working together on the necessary developments (upgraded Compton polarimeter, Fast DAQ, …). The key elements of the experimental set-up are the 2 HRS spectrometers, liquid cryogenic targets (H and D), a polarized electron beam with PV quality and a fast acquisition system allowing for a counting method to reject pion background. Concerning the beam, the size of the asymmetry to be measured is large (50-100 ppm) and the beam performances achieved in Hall A exceed in quality routinely the requirements of this proposal. The beam energy and spectrometer settings have been optimized leading to the choice of a 4.8 GeV beam and a 12.5° detection angle for the scattered electrons.

Issues: This PAC felt that the experiment addresses a number of important issues. However, in competition for very limited beam time, no single issue was sufficiently compelling to approve the experiment. The part related to the neutrino physics case would benefit, in a new proposal, from more quantitative arguments and might request inputs from theorists and physicists involved in this field.

Recommendation: Defer with regret

Individual Proposal Report

Proposal: PR-06-006

Scientific Rating: N/A

Title: The $\gamma p \rightarrow \pi^+ n$ Single Charged Pion Photoproduction

Spokespersons: D. Dutta, H. Gao, R. Rossi

Motivation: The proposal seeks to measure single pion production at large 4-momentum transfer as a means of studying the transition from meson-nucleon degrees of freedom to quark-gluon degrees of freedom in the hadron invariant mass range from 2.15 to 3.35 GeV. The motivation is based on the observation that in processes like pp-scattering, deuteron photo-disintegration and pion photo-production the cross sections globally scale according to constituent quark counting rules, for the considered case namely with s^7. With this experiment the existing data set on cross sections and angular distributions would be greatly expanded in volume and precision and more refined studies on the acting degrees of freedom could become feasible.

Measurement and Feasibility: The experiment requests 4 days of beam time in Hall B with a 25 nA electron beam of energy 5.7 GeV, consecutively following the G12 run. A tagged photon beam of the energy range of 2.0 to 5.4 GeV would be directed on a 40 cm LH_2 target in CLAS and a dedicated single charged particle trigger be used. The rate estimates of the proposal are based on an experiment that ran at 4 GeV electron beam energy, the expected trigger rates amount to 4 kHz, roughly exhausting the CLAS DAQ system capabilities. MC-simulations have been performed and indicate the feasibility of the experiment.

Issues: While the study of photo-production of pions in the proposed energy regime is considered interesting in itself as a tool to explore and identify the active degrees of freedom, the PAC finds it unlikely that the study of production cross sections in this energy region can readily allow for definitive conclusions on partonic mechanisms at work. This is not helped by the fact that theoretically absolute cross sections are not readily calculable, even though its global s-dependences comply with the expected scaling behavior. For a stringent study of this transition region a detailed treatment of resonant contributions to this process is mandatory. The proposed measurement may in fact provide data useful for the search for new resonances, but the design is not optimized for that physics. The goals of the proposal could be attainable more convincingly at higher photon energies, making the proposed pion production a more compelling case.

Recommendation: Defer

Individual Proposal Report

Proposal: PR-06-007

Scientific Rating: A

Title: Impulse Approximation limitations to the (e,e'p) reaction on ^{208}Pb, identifying correlations and relativistic effects in the nuclear medium

Spokespersons: K.A. Aniol, A. Saha and J.M. Udias

Motivation: The experiment would explore the limits of nuclear many-body theory, where the single-particle states of the shell model provide the leading term in an expansion of correlations. Correlations allow nucleons to occupy orbits above the Fermi level, and so reduced occupations below the Fermi level serve as their signature. While Spectroscopic factors in (e,e'p) provide a standard testing ground, the inclusion of a variety of many-body effects such as short-range as well as long-range correlations and relativistic effects have produced similar predictions. Disentangling these in any conclusive way has not yet been accomplished. The goal of this experiment is to focus on a few observables that can in principle separate these effects. In addition, ^{12}C(e,e'p) experiments at Mainz have suggested a possible Q^2 dependence to spectroscopic factors, a controversial result which is not accommodated by any calculations.
Extensive calculations have been carried out and have shown that excess strength in the cross section at high missing momenta is a definitive signature of long-range correlations, while the transverse-longitudinal asymmetry, A_{TL} , has a clear sensitivity to relativistic effects. These can be investigated in the present experiment, along with the Q^2 dependence of Spectroscopic factors.
The improvement in the machinery of the calculations that will potentially result from this study could have significant implications for the reliability of predictions important for experiments at the planned Rare Isotope Accelerator.

Measurement and Feasibility: The experiment will utilize a diamond-lead target with the two HRS spectrometers in Hall A to measure ^{208}Pb(e,e'p) under quasi-elastic conditions to all 5 low-lying holes states in ^{207}Tl that make up the 6th nuclear shell. A fixed energy of E_e = 2.445 GeV and momentum-transfer q = 1.0 GeV/c have been chosen to match the kinematics of a previous ^{16}O(e,e'p) experiment, which increases the potential impact of this study.
Of the five hole states, two pairs are within 330 keV while the HRS resolution is about 500 keV, so that two pairs of final states are overlapping. Their separate contributions will be determined in fits with the line-shape fixed to a ^{209}Bi(e,e'p) spectrum and the missing mass calibration determined from ^{209}Bi and ^{12}C reactions. Extensive simulations have shown that, with the planned statistics, this fitting procedure will be reliable to the 5 - 10% level, which is sufficient for the goals of the experiment. This procedure will be used to determine cross sections out to 500 MeV/c in missing momentum. Spectroscopic factors and the A_{TL} asymmetry will be deduced for each hole state.
Theoretical calculations, folded with the acceptance and resolution of the spectrometers and binned with realistic momentum intervals, have shown that the sensitivities to long-range correlations and to relativistic effects remain significant under the planned experimental conditions.

Recommendation: Approve for 10 days in Hall A

Individual Proposal Report

Proposal: PR-06-008

Scientific Rating: A

Title: Update for PR 05-108: G0 Experiment Backward Angle Measurement at $Q^2 = 0.23$ GeV^2

Spokesperson: D. H. Beck

Motivation: The G0 Collaboration proposes to measure the longitudinal asymmetry in e-p and e-d scattering at backward angles and a momentum transfer of Q^2=.23 GeV^2. These data with the G0 forward angle data at Q^2=.23 GeV^2 will determine the electric and magnetic and axial form factors. The form factors will in turn determine the strangeness distribution of the nucleon. The G0 experiment is one of the most visible parts of the JLab program and the successful completion of the G0 measurements is of great interest to the nuclear-physics community.

Measurement and Feasibility: Based on technical issues raised by the Technical Advisory Committee, the PAC requested that the Collaboration address a number of technical issues such as specification of beam properties such as halo and parity-correlated modulations, detector performance criteria, backgrounds, and radiation levels. The PAC also requested a set of milestones and a commissioning plan as well as a set of auxiliary measurements. The Collaboration responded to these requests in a professional manner, and all the issues raised by the TAC appear to have been met. The measurement appears to be technically feasible, if the new backward detector configuration meets its performance specifications and backgrounds are under control.

Issues: The backward-angle set up and detectors will be tested in the commissioning phase of the Q^2=.63 GeV^2 run. The PAC advocates that the results of the commissioning run be carefully reviewed by the TAC. The phase of the experiment under discussion is not compatible with running other experiments at JLab. At the time the experiment was considered by PAC 28 it was believed that 50 days of running supported by the FEL facility at JLab. would be available in Summer 06. That time appears to have been reduced to 25 days. In addition, the JLab. budget has been reduced by 8%. The completion of the Q^2=.23 GeV^2 run in FY06 appears not to be possible.

Recommendation: Approve 34 days of running in 2006 for Q^2=.23 GeV^2.

Individual Proposal Report

Proposal: PR-06-009

Scientific Rating: A$^-$

Title: Measurement of $R = \sigma_L / \sigma_T$ on Deuterium in the Nucleon Resonance Region

Contact Persons: M.E. Christy, C. Keppel

Motivation: The transverse-longitudinal structure functions F_1 (x,Q^2) and F_L (x,Q^2) would be extracted using the Rosenbluth technique in the resonance region ($1 < W^2 < 4$ GeV^2) spanning the Q^2 range $2 < Q^2 < 5$ GeV^2. This measurement adds unique information on the deuteron and the neutron and is critical in several aspects. It allows for the determination of the neutron singlet and non-singlet (proton-neutron) combination of the moments of the F_L structure function. These moments are dominated by the large x (resonance) data proposed in this experiment. With
the help of Lattice QCD calculations at Q^2 above 2 GeV^2, these data would allow us to gauge the size of higher twists contributions. Using duality, which seems to work quite well on the proton, these precise data will add information on the down quark parton distributions at large x and moderate Q^2. Furthermore, a precision measurement of R is needed for the determination of the deuteron and neutron spin structure functions g_{1d} and g_{1n} in the resonance region. Finally, these data are directly relevant to neutrino oscillation experiments like MINOS by providing unique constraints on models of low energy neutrino interactions. These measurements are complementary to the neutrino-scattering data anticipated by the MINERνA experiment.

Measurement and Feasibility: This experiment would be performed in Hall C using the HMS spectrometer to detect scattered electrons. Part of this previously approved experiment has already been performed at $Q^2 = 0.5$ and 2 GeV^2. The collaboration has all the tools and expertise to reach the quoted uncertainties on the ratio R. Similar precision has been achieved in the measurement of R on the proton which was performed by the same collaboration in experiment E94-110. The quoted error bars in the extraction of F_L and R in the deuteron are realistic.

Issues: By optimizing the kinematics the PAC believes that the allocated beam time is adequate to fulfill the keys goals of the experiment and supports the group's suggestion to restrict the measurements to $Q^2 < 4$ GeV^2.

Recommendation: Approve for 9 days in Hall C

Individual Proposal Report

Proposal: PR-06-010 and PR-06-011

Scientific Rating: A

Title: Target Single Spin Asymmetry in Semi-Inclusive Deep-Inelastic Negative (and Positive) Pion Production on a Transversely Polarized ^{3}He Target

Spokespersons: X. Jiang, J-P. Chen, J.-C. Peng / X. Jiang, H. Gao, E. Cisbani

Motivation: This report concerns two Hall A proposals: P-06-010 and P-06-011. The first one is an update of the PAC23 approved (B+) experiment E03-004; the other one is new. The two aim at studies of target single spin asymmetries in the semi inclusive deep inelastic interaction with a transversely polarized helium-3 target, $n\uparrow(e,e'\pi)X$; in P-06-010 the pion is negative, in P-06-011 it is positive. Both proposals aim at performing the first SSA measurements on a transversely polarized neutron target provided by a polarized ^{3}He.

Measurement and Feasibility: It is proposed to measure the azimuthal distribution of pions in the reaction $n\uparrow(e,e'\pi)X$ with a polarized helium target in Hall A. A 6 GeV beam will be used together with the BigBite and HRS spectrometers to detect electrons and pions respectively, the latter in the direction close to that of the virtual photon. Kaon asymmetries will also be measured and to this aim the RICH detector used during the pentaquark searches and hypernuclear experiments will be re-installed. The Hall A polarized helium target, successfully used in other experiments will be modified to allow complete freedom in choosing the polarization direction and to permit its frequent flip. The target fringe field problem seems to be fully under control. The measurement appears to be fully feasible.

Issues: Since 2003, physics related to transversity measurements has become a very hot topic, rapidly developing both experimentally (HERMES, COMPASS, RHIC-spin) and theoretically. The recent HERMES results on the proton show a large (and opposite in sign) effect for positive and negative pion production in the Collins moments and large (for π^+) Sivers moments while COMPASS, performed at much higher energy on the deuteron, does not show any significant asymmetry in either case. The HERMES data are pointing towards unexpected conclusions or, alternatively, could be a sign of factorization breaking effects. New measurements are thus desired, especially in the HERMES kinematical range and on a different target (neutron) to both clear up the situation and extract interesting observables. The proposed measurements will cover the HERMES kinematic range, albeit with larger statistical errors.
The PAC recommends beam time under the condition that both groups form a single collaboration and present the Laboratory a detailed plan of joint measurements of asymmetries with both positive and negative pions.

Recommendation: C1-approval for 29 days in Hall A

Individual Proposal Report

Proposal: PR-06-012

Scientific Rating: N/V

Title : A Parasitic Measurement During E-03-004 for Target Single-Spin Asymmetry in Inclusive DIS $n^{\uparrow}(e,e')$ Reaction on a Vertically Polarized ^{3}He Target

Spokespersons: X. Jiang, T. Averett, R. Gilman and T. Holmstrom

Motivation: The proposal is aimed at performing a measurement of inclusive transverse target single spin asymmetry, with a precision at the 5 10^{-4} level, improving by a factor 50 the precision of the previous data collected at SLAC. This measurement is related to determining the two-photon effect at the quark level. A large signal observed at this level of precision would point towards the chiral symmetry breaking, beyond the leading twist QCD picture of DIS.

Measurement and Feasibility: The time requested is only 1 day making opportunistic use of the beam time of other proposals (E-06-010 and E-06-011) approved for data taking. The experimental set-up would then basically be the one used by these experiments.
This set-up would mainly consist of a polarized high luminosity (40 cm long) ^{3}He target, and of the BigBite spectrometer for the detection of the scattered electrons. Inclusive data would be recorded. The kinematics would be the same as for the 2 other proposals: beam with a 15 μA intensity, energy of 6 GeV and 80% longitudinal polarization, BigBite set at 30°. Only the data recorded with the target polarization oriented vertically would be used to extract the signal, the other spin orientation in principle giving a zero signal could be used to determine systematic effects.
The precision of the asymmetry to be reached (100 ppm) requires beam parity quality. However the performances requested are well within those of previous parity violation experiments in Hall A. Also a fast reversal of the target polarization will be used (10-20 minutes) with a quartet structure.
The main experimental change would be the need of additional pion rejection capability in the BigBite spectrometer. It is proposed to use an aerogel Cherenkov counter which should provide an additional rejection factor of 10 in the pion rates. The inclusive rate should be kept at a level, which would not result in a dead time larger than 5% in E-06-010 and E-06-011.

Issues: The PAC has not been fully convinced by the strength of the physics case as presented in the proposal. Additional studies are requested in collaboration with theorists involved in the field of the 2-photon exchange.

Recommendation: Defer with regret

Individual Proposal Report

Proposal: PR-06-013

Scientific Rating: A^-

Title: Measurement of $\pi^+\pi^-$ Photoproduction in Double-Polarization Experiments Using CLAS

Spokespersons: V. Crede, M. Bellis, S. Strauch

Motivation: The existence of well-defined higher lying states tests the basic 3 quark structure of baryons embodied in SU(6)xO(3) symmetry of the conventional constituent quark model. Detailed predictions for all of these exist in the region from 1 – 2.5 GeV region to be explored in this experiment. If these states do not occur, this may point to a quite distinct underlying color structure, for instance a diquark-quark structure of baryons. The existence of such states is being studied in single pion and kaon photoproduction with unpolarized beams and targets. Such data can be fitted in very many ways with different resonant and non-resonant structures. These solutions can be distinguished by measurements of the single and double polarizations. Since the higher lying baryons, in particular, often decay by the emission of more than one pion with ρN and $\Delta\pi$ as dominant final states, the study of two pion photoproduction with double polarization observables is essential. This experiment should provide a vital piece of the construction of a model-independent coupled channel analysis required to unravel the complete N*, Δ* spectra**.**

Measurement and Feasibility: The proposed experiment will measure the asymmetries in $\pi^+\pi^-$ production with a circularly polarized photon beam on a transversely polarized proton target. 4 days of running should allow the relevant polarizations to be determined to an absolute statistical accuracy ± 0.05 over the whole accessible kinematic range. With the value of these polarizations expected to be of magnitude at most 0.3, the systematic errors should be far smaller than the statistical uncertainties. The first measurement of the double polarization in the 2π channel is an important step in the project of collecting and collating a complete set of observables

Recommendation: Approve for 4 days in Hall B

Individual Proposal Report

Proposal: PR-06-014

Scientific Rating: A-

Title: Precision Measurements of the Neutron d_2: Towards the Electric X_E and Magnetic X_B Color Polarizabilities

Spokespersons: B. Sawatzky, S. Choi, X. Jiang, Z.-E. Meziani

Motivation: The experiment will make a precision measurement of the g_2 structure function of the neutron from x=0.2 to 0.7, allowing a precision determination of the d_2 moment relevant to the color electric and magnetic polarizabilities in the neutron. This quantity can be compared to current lattice QCD calculations.

Measurement and Feasibility: The experiment uses a polarized electron beam of 4.6, 5.7 GeV and polarized ^{3}He target. The asymmetries will be measured by BigBite spectrometer at a single angle 45 degree and the absolute cross sections measured by L-HRS. The experiment avoids the resonance region.

Issues: Various technical and theoretical issues raised in the previous versions of the proposal have been satisfactorily addressed.

Recommendation: Approve for 13 days in Hall A

Individual Proposal Report

Proposal: PR-06-015

Scientific Rating: N/A

Title: Deeply Virtual Compton Scattering on the Deuteron with CLAS at 6 GeV

Spokespersons: M. Amarian, L. Elouadrhiri, H. Juengst, F. Sabatie

Motivation: The proposal suggests to measure deuteron GPDs (H_3 in particular) through single beam spin asymmetry using the CLAS detector.

Measurement and Feasibility: The measurement will be done at 6 GeV with a luminosity of 1.5 $\cdot 10^{34}/cm^2/s$ and a kinematical coverage of $0.1 < x_B < 0.3$ and $0.15 < -t < 1$ GeV^2 for $Q^2 > 1$ GeV^2. In additional to the standard CLAS configuration, the experiment requires the inner calorimeter and the solenoidal target magnet. It appears that the experiment is feasible.

Issues: The PAC felt that it is a good experiment to be done in the future. At present, however, priority shall be given to the proton GPD program and to fully understand its physics impact. The role of GPDs in nuclear physics is yet to be defined. In particular, one needs to understand what new information about the tensor structure of the deuteron can GPD H_3 provide.

Recommendation: Defer

Individual Proposal Report

Proposal: **PR-06-016**

Scientific Rating: N/A

Title: Search for the Modification of Vector Meson Properties in Nuclei

Spokespersons: D. P. Weygand, C Djalali, R. Nasseripour, and M. H. Wood

Motivation: The experimenters propose to seek evidence for a modification of the position and/or width of the ρ meson in the presence of nuclear matter. This is a subject that has attracted a great deal of attention in recent years and resulted in numerous papers, both experimental and theoretical. It is widely appreciated that the structure of the QCD vacuum plays a dominant role in the properties of hadrons. It would be extremely interesting if it could be convincingly shown that the properties of vector mesons are modified by the nuclear medium in which they reside.

Measurement and Feasibility: The experiment would use a photon beam in Hall B with the CLAS detector and a variety of targets including D_2, C, Fe, and Nb. The properties of the light vector mesons would be studied through their rare leptonic decay to e^+e^- pairs. While this decay mode has a branching ratio of 5×10^{-5}, it has the advantage of being purely leptonic and thus free of strong final-state interactions. The proposed experiment, g7b, is a follow-on experiment to g7a which had the same physics goals. During g7a it was found that the acceptance of the e^+e^- pairs was roughly a factor of five below what was expected in the original proposal resulting in a corresponding reduction in statistics. It was demonstrated during g7a, however, that the photon tagger is superfluous, and by eliminating tagging, the luminosity can be substantially increased. Through this and an increase in running time, g7b is projected to collect roughly four times the statistics of g7a. Other differences include substituting the Nb target for Pb, and possibly using the DVCS solenoid.
In analyzing the g7a data, there was no significant difference between fits that included mass shifts and fits that did not. The proposers were thus left with the difficult task of evaluating the impact of increased statistics in a quantitative manner. To do this, they developed a Monte Carlo where the events thrown were based on their actual observed data. By adding modifications corresponding to medium effects, they were able to generate events with and without changes in the properties of the ρ. They could then fit these two sets of events, and study the χ^2 as a function of the total number of events thrown. Using this approach, they concluded that with four times the statistics and a mass shift of as little as 30 MeV, the χ^2 / d.o.f. would increase to between 2-3.

Issues: While the committee agreed that a truly definitive demonstration of medium effects would be of tremendous value and quite exciting, there was considerable skepticism that the proposed experiment made a convincing case that it could do so. At best the effect would be identified through a statistical test. At worst, the background, which was essentially not understood, might contribute in some unanticipated manner to systematically skewing the results. The PAC felt that understanding the background would be of paramount importance for this measurement and that the efficiency of detection in such a measurement is not well matched to the CLAS detector.

Recommendation: Defer

Individual Proposal Report

Proposal: PR-06-017

Scientific Rating: N/A

Title: Measurement of the Gerasimov-Drell-Hearn Integral at low Q^2 on the Deuteron and Neutron

Spokespersons: A. Deur, G. Dodge, K. Slifer

Motivation: This proposal is a re-submission of PR-05-111 which had been deferred by PAC28.
The PAC28 had preferred to wait for data from E97-110 / Hall A before proceeding. The authors now propose to run this experiment consecutively to E03-006 in a window of opportunity for otherwise unused beam time which would make this data taking very efficient. They propose to measure the spin structure function $g_1(Q^2,x)$ of the deuteron in the low Q^2 range of 0.015 to 0.2 GeV ^{2} and W-range of 1 – 2 GeV with the CLAS detector. From these data they want to extract the Q^2 dependent first moment and the GDH sum, both for the deuteron and the neutron. This would complement the data on the proton, which will be taken in E03-006 by CLAS, allowing for a determination of the Q^2 dependent Bjorken sum from data using the same experimental set-up except for the target. An extrapolation to the photon point would be made to provide the original GDH sum for the deuteron and the neutron. The authors argue that the error contributions would be complementary to that of the polarized ^{3}He experiment E97-110 and a detailed comparison between ^{2}H and ^{3}He results would yield a better control on nuclear effects.

Measurement and Feasibility: The experiment requests 21 days of beam time with energies of 0.8, 1.34, 2.0 GeV and an electron polarization of $P_e = 0.8$. Standard CLAS instrumentation in connection with a polarized ND_3 target at a polarization of $P_D = 0.3$ would be used. No tune-up time would be needed if run as proposed.

Issues: The arguments of the authors to take advantage of a window of opportunity for otherwise unused beam time for this proposal were not substantiated by the laboratory. With the disappearance of this very favorable situation the PAC did not see that the reservations of PAC28 have changed.

Recommendation: Defer

Individual Proposal Report

Proposal: PR-06-018

Scientific Rating: N/V

Title: Threshold Contribution to the Deuteron Extended Gerasimov-Drell-Hearn Sum Rule

Spokespersons: K. Slifer, A. Deur

Motivation: The proposal is aimed at providing high precision data for the inelastic electron scattering off the deuteron near Two-Body breakup. The data would be of interest to the deuteron extended GDH sum rule, based on an integral of the polarized structure function g_1 of the deuteron which in turn appears in the longitudinal beam-target cross section difference. A strong cancellation is expected to occur between contributions below and above the pion threshold in the deuteron, making the corresponding sum rule smaller than the nucleon value by about two orders of magnitude.
The GDH sum rule is a topic of great theoretical interest and has been explored at several laboratories, with JLab specifically contributing to the extension of the sum rule to $Q^2 \neq 0$. The results of the measurement may also be used to constrain calculations about electron scattering off the deuteron in this specific energy region. However, this point was not addressed in the proposal. Moreover, there should be particularly exceptional reasons to use such low energy beam at JLab.

Measurement and Feasibility: The experiment would make use of the longitudinally polarized (80%) electron beam, with energies of 600 and 1200 MeV, and intensity in the order of 100 nA. It would also make use of the UVa ND_3 polarized target with 1 and 3 cm long cells. The experiment may be performed in connection with the approved experiments E03-109, E04-113, E05-101, that are using the UVa polarized target, thereby providing an opportunistic use of a major installation in Hall C. The scattered electrons would be detected in the standard Hall C HMS spectrometer, whose energy resolution would allow a separation of the electrodisintegration and quasi-elastic events near threshold. By measuring the longitudinal beam-target cross section difference, the experiment would determine a polarized structure function of the deuteron, whose integral over the threshold energy region provides the above mentioned important contribution to the GDH sum rule.

Issues: Following comments from the PAC and the TAC, a more appropriate subdivision of the beam time request has been developed, to take into account the overhead connected to polarization and dilution factor measurements. Possible issues with radiative corrections, high rates in the HMS and luminosity monitoring have been addressed and therefore the PAC does not see them as a concern for the experimental feasibility. Although connected to proposal PR-06-017 aiming at the determination of the contribution to the sum rule beyond the pion threshold, this proposal could stand by itself as a measurement of virtual photon absorption in the threshold region. Given the fact that measuring just the threshold region has a very limited physics impact and that JLab is not dedicated to these type of low energy experiments, we feel that this is not a measurement with a high physics priority.

Recommendation: Defer

Appendix E

Individual Letter of Intent Report

Letter of Intent: LOI-06-001

Title: Search for Deeply Bound K^- Systems via their two Body Decay

Spokespersons: E. Piasetzky, P. Markowitz, J. LeRose, F. Garibaldi, M. Iodice, F. Cusanno, S. Marrone

Motivation: Do deeply bound kaon states in nuclei? Several past experiments have suggested that this might be possible. The most recent of these was performed at the Frascati ϕ-factory DAΦNE with the FINUDA experiment. There, bound states are reported from peaks in the K^-pp mass distribution determined from back-to-back Λp events. An alternative interpretation in terms of K^- absorption without strong binding has been proposed. The motivation for this Letter of Intent is to perform an experiment to confirm whether such states are due to a deep K^- nucleus potential or not. The aim is to scatter electrons on different nuclear targets and trigger on ΛN and ΣN final states accompanied by a K^+

Measurement and Feasibility: The intended experiment is clearly feasible. However, the powerful critique by Oset and Toki clearly indicates that the FINUDA results need not be interpreted in terms of bound states in a deep K^- nucleus potential. The PAC is skeptical that any results obtained in the intended experiment can be unambiguously interpreted in terms of the K^- nucleus potential.

Recommendation: The PAC foresees considerable difficulties in interpretation of the results of such an experiment and the proponents need to give this serious consideration.

Individual Letter of Intent Report

Letter of Intent: LOI-06-002

Title: Measurement of the $\Delta\sigma^{\gamma N}$ (k) and the High Energy Contribution to the GDH Sum Rule.

Spokesperson: Y. Prok

Motivation: The experimenters propose to measure the high energy contribution to the GDH sum rule in the range $2.5 < k < 5.5$ GeV. Measurements of the GDH integral at lower energies over-saturate the sum rule, leading to the expectation that the contribution from the high energy piece is probably significant, an expectation that appears to be emerging from measurements that are just now becoming public. The committee had no doubts that the physics motivation for the experiment is solid.

Measurement and Feasibility: This experiment would measure the total cross section for photoabsorption over the range $2.5 < k < 5.5$ GeV using the CLAS detector and a new frozen-spin target. Circularly polarized photons would be produced by bremsstrahlung radiation from longitudinally polarized electrons incident on an amorphous radiator.

Issues: Like all real-photon total cross section measurements, an accurate result would require a successful measurement over all final states. CLAS lacks coverage at very forward angles, and has significant limitations in its photon detection efficiencies. The proposers have thus used a Monte Carlo to try to understand the expected detector performance, for which there could certainly be many questions. They propose to extract $\Delta\sigma^{\gamma N}$ (k) both by measuring absolute cross sections for each helicity state, as well as using measured asymmetries in combination with previously measured cross sections. While this would provide some level confidence, given some of the limitations of CLAS, it would make sense to try to reproduce cross sections for carbon and He-4 as well. The question of electron rejection also appears worrisome.

The experiment does not include polarimetry of the photon beam itself, planning instead to compute the polarization based entirely upon the polarization of the electron beam. This raises questions about the exact composition of the target seen by the incident photons, and it is not clear that this potential source of systematic error is under control.

Finally, the committee was concerned that thorough efforts to understand and calibrate the various issues raised above could result in a need for substantially more beam time than was indicated in the letter.

Recommendation: While the physics motivation for this measurement is strong, the committee was not at all convinced that the described measurement would be successful.

Individual Letter of Intent Report

Letter of Intent: LOI-06-03

Title: The EMC Effect in Spin Structure Functions

Contact Person: V. Dharmawardane

Motivation: The EMC effect has been well measured in the unpolarized structure functions of nuclei. However it has never been explored in the case of spin structure functions. It is proposed to perform the first measurements of the "spin dependent EMC effect" at Jefferson Lab.

Measurement and Feasibility: In this experiment it is proposed that the longitudinal double spin asymmetry $A_{//}$ would be measured in Hall B using the CLAS detector with a ^{7}LiH polarized target. The proposed Q^2 ($2 < Q^2 < 5$ GeV^2) and *x* span would cover the valence quark region, the same region where the unpolarized EMC effect is defined as well as the resonance region. The virtual photon-nucleus asymmetry A_1 will be extracted after corrections which include beam and target polarizations, dilution factor, A_2 contamination and depolarization factor D($R = \sigma_L / \sigma_T$). The ^{7}Li target is a spin 3/2 target which implies that tensor polarization will be present but cancelled by reversing the target spin along the beam direction. Nuclear structure corrections will be applied to extract the spin structure g_1 of the proton in ^{7}Li and compare it to the free proton one.

Issues: The "spin dependent EMC effect " is experimentally difficult to define. Since we cannot polarize all the nucleons in a given nucleus, the concept of mean field spin effect is ill defined compared to the unpolarized case. The spin structure function of a nucleus g1 is the product of the asymmetry A_1 with the unpolarized structure function F_1. The unpolarized structure function F_1 has obviously a well defined "EMC" effect and A_1 is an already small quantity which decreases with the atomic number A of the nucleus. Given the uncertainty in the nuclear spin structure effects and the small size of the asymmetry A_1, it will be difficult to extract what the proponents call the "spin EMC effect".

Recommendation: The PAC is skeptical that the interpretation of such a measurement would be meaningful.

Individual Letter of Intent Report

Letter of Intent: LOI-06-004

Title: First Measurement of Polarized EMC Effect for the Neutron

Spokespersons: X. Zheng, A. Deur

Motivation: This LOI describes an experiment aiming at measuring the EMC effect in polarized structure function for the neutron by combining results measured in DIS scattering on polarized ^{3}He and ^{129}Xe targets (alternatively ^{21}Ne). The results of this measurement would provide the first data on polarized EMC effect.

Measurement and Feasibility: The experiment is proposed to be performed in Hall A using the standard HRS spectrometers to detect the scattered electrons and discriminate them from the pions. Due to the smallness of the expected asymmetries in the case of nucleus target, a parity beam quality is required but with specifications that are now standard in Hall A.
The main technical issue is to build/operate the polarized nuclear target. It appears that only two of the noble gas can be used for the polarized target:^{129}Xe is preferred over ^{21}Ne. Although the latter one would be more difficult to polarize, it might be the only choice if difficulties in calculating the nuclear corrections for the ^{129}Xe nucleus from theory are too challenging.

Issues : The authors have made clear the serious challenges in both theoretical and experimental aspects. For the latter, the experiment requires a polarized heavy nucleus. Although required technique already exists, and solutions are foreseen to handle problems with the ^{129}Xe, such development are likely to last for several years. Theoretically, how to do nuclear corrections remains a challenge for nuclear theorists.
The "spin dependent EMC effect" is experimentally difficult to define. Since we cannot polarize all the nucleons in a given nucleus, the concept of mean field spin effect is ill defined compared to the unpolarized case. The spin structure function of a nucleus g1 is the product of the asymmetry A_1 by the unpolarized structure function F_1. The unpolarized structure function F_1 has obviously a well defined "EMC" effect and A_1 is an already small quantity which decreases with the atomic number A of the nucleus. Given the uncertainty of the nuclear spin structure effects and the small size of the asymmetry A_1, it will be difficult to disentangle what the proponents call the "spin EMC effect".

Recommendation: The PAC remains skeptical that data, if successfully recorded, could be interpreted in a meaningful way.

Individual Letter of Intent Report

Letter of Intent: LOI-06-005

Title: Kaon Production on the Deuteron Using Polarized Photons

Spokespersons: P. Nadel-Turonski and B. Berman

Motivation: This Letter of Intent describes a potential CLAS measurement of kaon production with linearly and circularly polarized tagged photons. In addition to beam asymmetry data, the self-analyzing decays of the Λ and Σ hyperons would provide beam-recoil double-polarization observables. In total, eight different observables could be accessed. The small analyzing powers of the hyperon decays would be compensated with a high luminosity 40 cm liquid D_2 target.
The emphasis of the proposed experiment is hyperon production from the neutron, with the goal of searching for *missing resonances* that couple weakly to pion channels. In fact, both neutron and proton data are essential to the extraction of photon-couplings of even existing N* resonances. The proposed hyperon channels would provide a very valuable input to coupled-channel analyses that provide the best hope for ultimately discovering as yet unidentified baryon resonances predicted by quark models, or ruling out their existence.

Measurement and Feasibility: The $\gamma n \rightarrow (K^o)(\Lambda) \rightarrow (\pi^+\pi^-)(p\pi^-)$, $\gamma n \rightarrow (K^o)(\Sigma^o) \rightarrow (\pi^+\pi^-)(\Lambda\gamma) \rightarrow (\pi^+\pi^-)(p\pi^-\gamma)$ and $\gamma n \rightarrow K^+\Sigma^-$ channels would be efficiently handled by the charged-particle detection capabilities of the CLAS. However, methods to deduce observables on the *free* neutron in deuterium should be studied in more detail, since this will strongly affect the impact of the proposed data within the larger JLab baryon resonance program.
Linear photon polarizations would be produced by coherent bremsstrahlung. The resulting high-polarization peaks are relatively narrow, so that several beam energy settings will be needed. The plan allows freedom in the choice of energy, which provides flexibility in scheduling. On the other hand, in this mode fewer data points would be collected simultaneously and as a result the advantage of a single common systematic uncertainty which affects a large data set only as a scale factor will be lost. In addition, some settings will require the highest electron energies. The coherent bremsstrahlung spectrum should be checked to insure high fluxes at low energies do not lead to excessive accidentals.

Recommendation: The physics motivations of this Letter of Intent are strong and the PAC encourages the proponents to develop this into a full proposal.

Appendix F

Jefferson Lab Experiments, PAC 4-29, Grouped by Category

(To access Appendix F, go to http://www.jlab.org/exp_prog/PACpage/pac.html)